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"White Squawk" of Mr. Knudson's boyhood days, which he himself shot in our presence and gave us for identification in 1904, and which specimen we still possess—these are facts.

Then, too, the immensity of undisturbed marsh, affording the best of both feeding and breeding grounds, together with the mild climate of the winters in this Great Basin, where the temperature rarely drops to zero, may offer a justification for its residence here. The birds have increased since our first observations, for annually they are spreading out into new colonies. How much real increase this may mean, we are unable to estimate; for Mr. Knudson tells us that in years past the birds returning each spring fluctuated in number—one spring would find a large colony returned, the following spring only a few pair would occupy the rookery. Is this to be laid at the door of the plume-hunter or did a portion of the birds choose another locality for that year? But the very marked increase since 1904 would indicate that the protection afforded the Snowy Heron here and elsewhere, is having its effect. At our last Legislature a law was passed protecting all bird life in the State, except the Magpie; and the law has not lacked enforcement. Mr. Fred Chambers, State Game Commissioner, with his deputies, and Mr. James Knudson, State and Federal Deputy Warden, have exerted untiring vigilance for the protection of all wild life in Utah.

*Salt Lake City, September 10, 1914.*

## THE EFFECTS OF IRRIGATION ON BIRD LIFE IN THE YAKIMA VALLEY, WASHINGTON

By CLARENCE HAMILTON KENNEDY

THE FOLLOWING article is from observations made while ranching in the Yakima Valley, Washington, during the years from 1909 to 1914. My ranch was an irrigated forty acres, less than ten acres of which was in vineyard and orchard, the remainder being in alfalfa and plow land. The estimates of the number of resident birds in the Yakima Valley are largely based on the numbers which have nested on my forty acres or on land adjoining, which area, though small, was under close and continuous observation for four years. Estimates are not as difficult on an irrigated tract as might seem to an easterner used to the great variety of conditions in a given territory, as on any new irrigation project the conditions are remarkably uniform throughout.

These notes deal only with species resident during nesting time and apply to that part of the valley about thirty miles long and ten miles wide at its widest, which lies between Union Gap and Grandview. Before irrigation, this part of the valley, excepting the narrow strip of verdure along the Yakima River, was a sage brush waste, dotted with sand dunes, and except for an ephemeral spring vegetation following the five to ten inches of winter rainfall, was a true desert.

As its bird population, with the exception of the grouses, now nearly extinct, probably did not differ from that of the sage regions of the valley today, the following list of species resident at the present time in the sage gives us a view of the former bird life in that portion now irrigated.

Columbian Sharp-tailed Grouse. *Pedioecetes phasianellus columbianus*. Formerly common but not seen recently.

Sage Grouse. *Centrocercus urophasianus*. Formerly common but now breeding only in the Rattlesnake Mountains.

Western Mourning Dove. *Zenaidura macroura marginella*. Rarely seen in the sage brush, probably nesting there.

Short-eared Owl *Asio flammeus*. Rarely seen in the sage brush.

Burrowing Owl *Speotyto cunicularia hypogaea*. Common, nesting along the ravines. I believe they will average from four to ten pairs to the square mile.

Say Phoebe. *Sayornis sayus*. Rarely seen in the brush

Dusky Horned Lark. *Otocoris alpestris merrilli*. The most abundant brush species, probably averaging from twenty to forty pairs to the square mile.

Western Meadowlark. *Sturnella neglecta*. The second most abundant species, with perhaps ten or more pairs to the square mile.

Western Vesper Sparrow. *Pooecetes gramineus confinis*. This was not common in the sage area near my ranch, but was numerous east of Sunnyside, where I had little opportunity of observing it. The same applies to the next species.

Brewer Sparrow. *Spizella breweri*.

White-rumped Shrike. *Lanius ludovicianus excubitorides* Occasional.

Sage Thrasher. *Oreoscoptes montanus*. Probably five pairs to the square mile.

This desert area was bounded on the south by the Yakima River, two hundred feet wide normally, but during spring floods spreading over the bottoms to a width of a half mile. The river, in its thickets of roses, elders and sumacs, above which rose the alders and cottonwoods, supported a bird fauna entirely different from that of the desert, and the nucleus from which sprang later the abundant bird life of the irrigated land. The following is a list of the species which nest either on the river banks, in the thickets and trees, or about the ponds left in the river bottoms by retreating high waters.

American Black Tern. *Hydrochelidon nigra surinamensis*.

Cinnamon Teal. *Querquedula cyanoptera*.

Shoveller. *Spatula clypeata*.

Great Blue Heron. *Ardea herodias*.

Coot. *Fulica americana*.

Spotted Sandpiper. *Actitis macularius*.

Killdeer. *Oxyechus vociferus*.

Western Mourning Dove. *Zenaidura macroura marginella*.

Marsh Hawk. *Circus hudsonius*.

Sharp-shinned Hawk. *Accipiter velox*.

Western Red-tail *Buteo borealis calurus*.

Sparrow Hawk *Falco sparverius phaloea*.

Belted Kingfisher. *Ceryle alcyon*.

Lewis Woodpecker. *Asyndesmus lewisi*.

Red-shafted Flicker. *Colaptes cafer collaris*.

Western Nighthawk. *Chordeiles virginianus henryi*.

Black-chinned Hummingbird. *Archilochus alexandri*.

Rufous Hummingbird. *Selasphorus rufus*.

Eastern Kingbird. *Tyrannus tyrannus*.

Arkansas Kingbird. *Tyrannus verticalis*.  
 Say Phoebe. *Sayornis sayus*.  
 Magpie. *Pica pica hudsonia*.  
 Black-headed Jay. *Cyanocitta stelleri annectens*(?).  
 Yellow-headed Blackbird. *Xanthocephalus xanthocephalus*.  
 Red-wing Blackbird. *Agelaius phoeniceus*, subspecies?  
 Bullock Oriole. *Icterus bullocki*.  
 Brewer Blackbird. *Euphagus cyanocephalus*.  
 Pale Goldfinch. *Astragalinus tristis pallidus*.  
 Western Savannah Sparrow. *Passerculus sandwichensis alaudinus*.  
 Western Lark Sparrow. *Chondestes grammacus strigatus*.  
 Western Chipping Sparrow. *Spizella passerina arizonae*.  
 Merrill Song Sparrow. *Melospiza melodia merrilli*.  
 Spurred Towhee. *Pipilo maculatus megalonyx*.  
 Lazuli Bunting. *Passerina amoena*.  
 Bank Swallow. *Riparia riparia*.  
 Yellow Warbler. *Dendroica aestiva*.  
 Western Yellow-throat. *Geothlypis trichas occidentalis*.  
 Interior Tule Wren. *Telmatodytes palustris plesius*.  
 Western Robin. *Planesticus migratorius propinquus*.  
 Mountain Bluebird. *Sialia currucoides*.

As already stated, the area under discussion is about thirty miles long and ten wide at its lower end, which, because of its triangular shape, gives an area of about 150 square miles. Of this area 62,000 acres are in alfalfa, plow land, and orchards. Various private companies in the past have attempted to water this area, but the final development has been by the Reclamation Service, whose work, just completed, has extended over the past ten years. As this land came under irrigation the various species of birds adapted to the changed conditions spread out from their former haunts along the Yakima River and took possession of this new territory. A few species from the previous desert have managed to survive, others have retreated into the yet un-irrigated sage, while others have adapted themselves to the new condition with a wonderful increase in numbers.

The figures which I give of the actual number of individuals of each species, are only estimates, and some may be greatly in error; yet they are based largely on four years observation of the species nesting on a definite area under general valley conditions, and are more satisfactory than the rather indefinite adjectives usually used, whose values vary with each observer and each locality.

In the list of species already given as representing the probable desert condition, the following changes have occurred. The two species of grouse, the Dusky Horned Lark, Brewer Sparrow and Sage Thrasher, refusing to live separate from their beloved sage brush, have retreated before the irrigation, and none are now found on the tract. The Burrowing Owl has neither surrendered his territory nor apparently increased in numbers, but still hangs on tenaciously, digging his burrows in the unirrigated knolls and along the dry roadsides. The Short-eared Owl is more abundant than in the dry land, and like the Burrowing Owl nests on the dry knolls. It is very abundant in the fall and winter but the large number is probably made up mostly of immigrants. Say Phoebe, the Western Vesper Sparrow and the White-rumped Shrike have accepted the new conditions and are more often met with than in

the sage brush, but real prosperity has come most markedly to the Mourning Dove and the Meadowlark. Each year for the past three years two pairs of doves have nested on my forty acres, at which rate for the 62,000 acres of the entire tract there would be 6200 doves. This past year four pairs of Meadowlarks nested on my ranch simultaneously, which would indicate for the entire tract 12,400 Meadowlarks.

Among the species previously limited to the river banks and thickets the following have taken advantage of the extended mesophytic condition and have variously profited accordingly. The Killdeer has noisily laid claim to every puddle of waste water, and has taken advantage of every barnyard. Nesting observations indicate a population of about 6000 for the entire tract. The Arkansas Kingbird, without waiting for suitable nesting sites, has temporarily built his nest on the electric poles and hay derricks. Though one of the most conspicuous species, nest data would indicate a total population of not over 1000 individuals. The Eastern Kingbird is about one-tenth as abundant as the Arkansas, and Say Phoebe is less common yet. Bullock Oriole is another species restricted by suitable nesting sites. It does not nest in young orchards, but every poplar windbreak has from one to half a dozen nests. A thousand individuals would be a fair estimate. Of the species of blackbirds found along the river, Brewer is the only one which has spread. It is a common dooryard bird, and with the exception of the robin is the species most friendly to man. It nests in weeds along all the larger ditches, also in colonies in the greasewood along the river, and in bushes and vines about farm houses. It is the third most abundant species, with at least 10,000 individuals. The Song Sparrow is the second most abundant species, running close to the Meadowlark in point of numbers. Because of its peculiar habit of nesting near water, giving it an irregular distribution, its numbers are less easily computed, but there are at least 10,000 on the entire tract. The Bank Swallow has occupied the cuts along the forty miles of main canal with a total number of probably 2000; and the Robin is nesting in the door yards and young orchards, with a total of about 2000 individuals.

The following species are common but have not appeared yet in numbers sufficient to estimate them:—Flicker, Nighthawk, Black-chinned and Rufous Hummingbirds, Say Phoebe, Pale Goldfinch, Western Savannah Sparrow, Western Lark Sparrow, Western Chipping Sparrow, Lazuli Bunting and Mountain Bluebird.

In the lower parts of this irrigated tract many ponds were formed by seepage and waste irrigating water. Their banks were sown by the wind-blown tule seed, making a habitat quickly occupied by the following species:—American Black Tern, Cinnamon Teal, Shoveller Duck, Coot, Marsh Hawk, Yellow-headed Blackbird, Red-winged Blackbird and Interior Tule Wren.

These species, from what I can learn, thrived about these ponds for about ten years, but last winter all the ponds were drained, driving the birds back to their former haunts about the permanent ponds in the river bottoms.

The following species found along the river, except as occasionally foraging over the irrigated land, have remained unaffected by the changed conditions:—Great Blue Heron, Spotted Sandpiper, Sharp-shinned, Red-tailed and Sparrow Hawks, Kingfisher, Magpie, Black-headed Jay, Spurred Towhee, Yellow Warbler and Western Yellowthroat.

The English Sparrow has followed man in, and is now common in the towns. The Ring-necked Pheasant (*Phasianus torquatus*) and the Bob-white

Quail (*Colinus virginianus*) have been introduced as game birds. Both have thrived. The pheasant is very abundant, averaging at least a pair to each twenty acres. The quail are abundant in the river bottoms and are beginning to be common in the higher parts of the tract.

To sum up:—The following species have prospered greatly in the newly irrigated territory:—Killdeer, Mourning Dove, Arkansas Kingbird, Bullock Oriole, Brewer Blackbird, Merrill Song Sparrow, Bank Swallow, Western Robin, Ring-necked Pheasant and Quail.

To get a general idea of the actual increase in numbers of the birds through irrigation, the following table based on the previous estimates is given. The figures, as I have stated at the beginning of the article, are given for what they are worth in an attempt to substitute something more exact for indefinite adjectives.

	Before irrigation	After irrigation
Killdeer .....		6,000
Mourning Dove .....		6,200
Burrowing Owl .....	2,000	2,000
Arkansas Kingbird .....		1,000
Bullock Oriole .....		1,000
Meadowlark .....	2,000	12,400
Brewer Blackbird .....		10,000
Horned Lark .....	8,000	
Song Sparrow .....		10,000
Bank Swallow .....		2,000
Sage Thrasher .....	1,000	
Robin .....		2,000
Pheasant .....		6,200
Quail .....		2,000
Other species .....	10,000	20,000
Total .....	23,000	80,800

All the species common now appear to be beneficial to agriculture with the possible exception of the Sharp-shinned Hawk, which perhaps might be classified with those species benefiting by irrigation, though I do not know that it nests away from the river. It is apparently increasing in numbers and no small bird is safe from its daring evolutions under orchard trees and through thickets.

The Sage Thrashers, as I have described previously in *The Auk*, nest in the sage brush but later bring their young into the irrigated areas where they live largely on small fruit. As these do not go in flocks larger than the family group, and are very local in their habitat, any family that becomes a nuisance can easily be shot out, thereby stopping any further thrasher damages for the season. Robins, if permitted, will usually take the sweet cherry crop, but that crop in this part of the valley is killed four years out of five by the frost, and the slight damage from the Robins is more than made up by the good they do.

One of the potential pests which hangs over the Yakima Valley is the Alfalfa caterpillar (*Eurymus eurytheme*). During my first summer in the valley these were abundant, but not enough so to seriously injure the crop. During the second haying that summer the leaves and litter about the stacks while harvesting the hay were fairly alive with the caterpillars, but since then they have not been so abundant. The Meadowlarks and Pheasants have apparently

increased in numbers, and with the Brewer Blackbirds search every newly cut alfalfa field for insects, and probably keep the caterpillar in check.

The valley fauna is noticeably lacking in the small arboreal insectivorous birds, such as vireos, warblers and chickadees, partly, perhaps, because of the scarcity of arboreal vegetation. All fruit trees have to be conscientiously sprayed.

The changed conditions have not only affected the resident species but have also attracted various winter visitants, the most abundant of which are the Gambel Sparrow (*Zonotrichia l. gambeli*) and, as I noted before, the Short-eared Owl. Various migrants spend several weeks in spring and fall, the most abundant species of which are the Audubon Warbler (*Dendroica auduboni*) and the Pipit (*Anthus rubescens*).

*Palo Alto, California, August 29, 1914.*

## BREEDING OF THE BRONZED COWBIRD IN ARIZONA

By M. FRENCH GILMAN

WITH TWO PHOTOS BY H. T. MURPHY

IN THE CONDOR for September-October, 1909, I recorded the capture at Sacaton, Arizona, of what at the time I believed to be the Red-eyed Cowbird. In the July issue of *The Auk* of that year Mr. S. S. Visser recorded a male taken at Tucson; but in a later number of the same journal he published a correction, stating that it was the Bronzed Cowbird (*Tangavius aeneus aeneus*), the form from northwestern Mexico, instead of the Red-eyed Cowbird (*Tangavius aeneus involucratus*), of Texas and eastern and southern Mexico, as was previously supposed. Soon after my note appeared in THE CONDOR Mr. Wells W. Cooke, of the United States Biological Survey, wrote me to send him a specimen of the female, and he pronounced the bird submitted, sent June 11, 1910, to be *Tangavius a. aeneus*.

The first year that these Cowbirds appeared at Sacaton I saw at least two pairs, and possibly more, and they were mating, so presumably breeding. The year 1910, the first one of the season was seen May 9. On July 12 I found a young one on the ground under a cottonwood tree, just below an inaccessible Bullock Oriole's nest. All that spring from the time the first bird appeared, I had been carefully examining nests of Abert Towhees and Red-wing Blackbirds, thinking perhaps the cowbirds might deposit their eggs therein, as there is some similarity in size and ground color of the eggs of these several species. I examined about fifty of the towhees' nests and about half as many of the red-wings', but without success. The number of cowbirds seen during 1910 was about the same as the year previous.

The year 1911 I was working on the north side of the Gila River about four miles from Sacaton, and did nothing with them that season, though occasionally seeing two or three on the lawns at Sacaton. The next season, 1912, I was located on the north side of the river at an Indian village called Santan, and was in a position to take up the study again. I saw the first Bronzed Cowbird of that season at Sacaton on May 25, and June 5, a male appeared